(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 099 457 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
03.09.2003 Bulletin 2003/36

(51) Int Cl.7: **A61M 39/24**, F16K 15/00

(21) Application number: **00830744.9**

(22) Date of filing: **10.11.2000**

(54) Check valve for medical infusion lines and the like

Rückschlagventil für medizinische Infusionsschläuche und dergleichen

Clapet anti-retour pour tubes de perfusion ou similaire

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
LT LV RO SI

(30) Priority: **12.11.1999 IT TO990973**

(43) Date of publication of application:
16.05.2001 Bulletin 2001/20

(73) Proprietor: **Industrie Borla SpA**
10024 Moncalieri (Torino) (IT)

(72) Inventor: **Guala, Gianni**
10133 Torino (IT)

(74) Representative: **Buzzi, Franco et al**
c/o Buzzi, Notaro & Antonielli d'Oulx
Via Maria Vittoria 18
10123 Torino (IT)

(56) References cited:
US-A- 3 465 786
US-A- 3 601 152
US-A- 3 804 113
US-A- 5 289 849
US-A- 5 305 795

EP 1 099 457 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention refers to check valves for medical infusion lines and the like.

[0002] Such check (or non return) valves normally comprise a first and a second tubular element including a first and a second tubular element positioned coaxially to each other to respectively define an upstream and a downstream passageway, and between which a diaphragm of elastically deformable material is transversely positioned, said diaphragm sealingly cooperating with an annular valve seat of the first tubular element to form a fluid seal that maintains said check valve in a normally closed position, and in which a predetermined fluid pressure in the upstream passageway causes a deflection of said diaphragm and consequent opening of the check valve.

[0003] Check valves of the above-referenced type are known from US-A-3465786 and US-A-3601152, wherein the annular valve seat is defined by a front surface of the first tubular element and said diaphragm consists of the bottom wall of a cup-shaped element positioned coaxially with said upstream and downstream passageways.

[0004] Such check valves must meet a series of critical requirements: in the first place, they must normally be closed and must only open, continuously or intermittently, when the pressure in the upstream passageway is higher than a predetermined threshold, normally of small entity e.g. 0.005-0.02 bar. The check valve must also be capable of preventing any reflux from the downstream passageway to the upstream passageway with utmost security, i.e. it must be capable of rapidly closing itself in cases where a minimal overpressure enters the downstream passageway.

[0005] Such a requirement is not met by the check valves according to the above-referenced prior art documents, whose cup-shaped element is

[0006] Another requirement of the check valves used in the medical applications in question consists in simple and low-cost design, in connection both with manufacturing and assembling of the check valve.

[0007] The object of the present invention is to provide a check valve of the above-referenced type wholly fulfilling the aforesaid requirements.

[0008] A further object of the present invention is to provide a check valve of the above-referenced type which is simply to adjust, upon manufacturing thereof, as a function of the user's need.

[0009] According to the invention these objects are achieved by the feature recited in the characterising part of Claim 1.

[0010] By virtue of this solution, in operation opening of the check valve takes place promptly even if the diaphragm constituted by the dome portion of the cup-shaped element is subjected to a relative high axial preload so as to ensure the maximum degree of closing safety and reliability. Moreover, in the open condition of the valve any increase of the fluid flow rate will result into a proportionally greater deformation of the bottom wall of the cup-shaped element and, thereofore, into a proportionally greater distance of the dome portion relative to the valve seat.

[0011] Further characteristics and advantages of the invention will be revealed during the detailed description that follows with reference to the enclosed drawings, which are supplied purely as a non-limitative example, wherein:

- Figure **1** is a schematic, axially sectioned view showing an axial fitting for medical infusion lines, incorporating a check valve according to the invention,
- Figure **2** is a sectioned view same as Figure 1 but rotated of 90°,
- Figure **3** is a cross section along line III-III of Figure 1,
- Figure **4** shows, in a reduced scale,a first variant of Figure 1,
- Figure **5** shows, in a reduced scale,a second variant of Figure 1,
- Figure **6** is a sectioned view along line VI-VI of Figure 5,
- Figure **7** shows, in a reduced scale,a third variant of Figure 1, and
- Figure **8** is a sectioned view along line VIII-VIII of Figure 7.

[0012] Referring initially to Figures 1-3,, refernce numeral 1 generally designates an axial fitting for tube-to-tube connection in medical infusion lines and similar. It should be immediately noted that it could also be set up for Luer-tube, tube-Luer or Luer-Luer connections.

[0013] The fitting comprises, in a way generally known per se, a first tubular connector 2 and a second tubular connector 3 both normally made of a relatively rigid plastic material, such as polycarbonate, acrylic polymers, ABS and the like, and are coaxially joined together in a permanent way, for instance by ultrasound welding or bonding or equivalent systems.

[0014] The first and the second tubular connectors 2, 3 define an upstream passageway, or inlet passageway 4, and a downstream passageway, or outlet passageway 5, respectively, which are designed to be connected to respective tubing sections of the medical line.

[0015] A check valve, generically indicated as 6 and specifically embodying the present invention, is arranged between the upstream passageway 4 and the downstream passageway 5.

[0016] The check valve 6 essentially comprises an elastic obturator consisting of a dome portion 8 projecting axially from the central part of the bottom wall 9 of a reversed cup-shaped element 7 which, in Figures 1 and 2, is depicted in a condition corresponding to the closed position of the valve

[0017] The cup element 7 comprises a shell lateral

wall 10 having a cylindrical design, more suitably with a conical surface diverging towards the side opposite to the dome portion 8.

[0018] The cup-shaped element 7 is normally made in one piece of soft elastomeric material, particularly liquid silicone or even thermoplastic rubber, that is injection moulded using a central injection point.

[0019] The cup-shaped element 7 can be of even thickness or, more suitably, can have a variable thickness namely greater in correspondence of the dome portion 8, smaller in correspondence of the annular bottom wall 9 and the again greater in correspondence of the lateral wall 10. Actually, the thickness of the side wall 10 may be more conveniently greater towards its free edge 11.

[0020] The dome portion 8 of the cup-shaped element is preferably flat, but may also formed at its outer circumferential edge with an annular rib defining a sealing lip 12.

[0021] The cup-shaped element 7 is fitted within a chamber 13 defined between the first tubular member 2 and the second tubular member 3, coaxially therewith. The chamber 13 is delimited at one side by a planar radial front wall 14 of the first tubular member 2, which defines in correspondence of the axially inner end of the inlet passageway 4 an annular valve seat with which the dome portion 8 (or the sealing lip 12 thereof) of the cup-shaped element 7 is cooperating.

[0022] On the other side, the chamber 13 is delimited by a channelled surface 17, coaxial to the outlet passageway 5, formed by a halo of radial channels 15 communicating with the outlet passageway 5. The radially outer end of each radial channel 15 merges into a respective axial channels 16 formed in the wall of the second tubular element 3 that laterally delimits the chamber 13.

[0023] As already mentioned, the cup-shaped element 7 is coaxially housed inside the chamber 13 with its dome portion 8 facing the inlet passageway 4 like a transversal diaphragm, and with its side wall 10 facing the axial channels 15. The free edge 11 of the lateral wall 10 rest upon the channelled surface 17 of the second tubular element 3.

[0024] The dome portion 8 (or the annular lip 12 thereof) is bearing against the annular valve seat 14 as shown iofn figures 1 and 2, whereby the valve is normally closed. The arrangement is such that in the closed condition the cup-shaped element 7 is subjected to a predetermined axial preloading: in this way the wall of the dome portion (or the annular lip 12 thereof) is urged into sealing contact against the annular valve seat 14, under the axial thrust applied by the side wall 10, through the annular bottom wall 9. As pointed out, this condition corresponds to the normally closed position of the check valve 6 according to the invention, in which flow from the upstream passageway 4 to the downstream passageway 5 is prevented in an effective and safe manner.

[0025] Whenever an overpressure exceeding a predetermined threshold, for instance in the range of 0.005-0.02 bar, develops in the upstream passageway 4, the anti-siphon check valve 6 automatically and promptly switches from the closed state to the open state, due to deflexion of the annular bottom wall 9 of the cup-shaped element 7, possibly combined with a partial, axial, elastic yielding of its side wall 10. This deflexion causes the surface of the dome portion 8 8 (or the annular lip 12 thereof) to move away from the annular valve seat 14. The upstream passageway 4 is thus put in connection with the downstream passageway 5 via the axial channels 16 facing the side wall 10 of the cup-shaped element 7 and the radial channels 15 located beneath the free edge 11 of the lateral wall 10.

[0026] In the open state of the valve 6, as the fluid flow increases, the annular bottom wall 9, and possibly also the dome portion 8 become proportionally more and more deformed and, as a consequence, the size of the flow path is proportionally increased.

[0027] The check valve 6 immediately returns to the closed position when the pressure balance between the upstream passageway 4 and the downstream passageway 5 is re-established, or in the case of overpressure in the downstream passageway 5, due to the annular bottom wall 9 returning to the non-deflected configuration and the dome portion 8 consequently returning to the contact position of its surface (or the annular lip 12 thereof) against the valve seat 14.

[0028] Calibration of the check valve 6 can be effected by simply working on the elastic characteristics of the cup-shaped element 7, e.g. varying the thickness of its bottom wall 9 or using materials of different hardness, or modifying assembling preloading thereof within the chamber 13.

[0029] The dome portion 8 is not strictly necessary, and in fact the three preferred alternative embodiments which shall be disclosed herebelow with reference to Figures 5 through 8 (wherein parts which are identical or similar to those already disclosed are indicated by the same reference numerals) havo no such dome portion. In these alternative embodiments the bottom wall 9 of the cup element 7 itself defines the diaphragm normally urged into seal contact against said annular valve seat 14 under the axial thrust provided by the lateral wall 10.

[0030] In all three alternative embodiments the side wall 10 of the cup-shaped element 7 has a cylindrical or conical surface diverging towards said channelled surface 17 and an increasing thickness from the bottom wall 9 towards its free edge 11. Moreover, in all three alternative embodiments the sealing lip 12 facing towards the valve seat 14 is provided at a distance from the lateral wall 10.

[0031] In the embodiment shown in Figure 4 the bottom wall 9 is slightly convex towards the valve seat 14, and the thickness of the area of the bottom wall 9 corresponding to the sealing lip 12 is reduced. The front surface defining the annular valve seat 14 is oriented with an angle different than 90° relative to the axis of

said first tubular element 2. For instance, the angle between the plane of the front surface 14 and the general plane of the channelled surface 17 of the second tubular element 3 may be comprised between 1° and 10°.

[0032] In the embodiment of Figures 5 and the bottom wall 9 is also slightly convex towards the valve seat 14, b while beeng provided of a substantially even thickness. The front surface defining the annular valve seat 14 is in this case perfectly radially oriented, i.e. is perpendicular to the axis of the firts tubular element 2.

[0033] Lastly, in the embodiment of Figures 7 and 8 the outer surface with the sealing lip 12 of the bottom wall 9 is generally planar, with an increasing thickness towards its center along a first diametral direction but with an elongated recess 18 formed in the inner surface of the bottom wall 9 along a second diametral direction . perpendicular to the first diametral direction. The design of the recess 18 may be different than the one depicted in the drawings.

[0034] Naturally, the constructional details and the embodiments could be extensively changed with respect to that described and illustrated without departing from the scope of this invention, as defined in the appended Claims. In addition, although the valve has been described with express reference as a check valve, it could easily be adapted for use as an anti-siphon valve.

Claims

1. A check valve (6) for medical infusion lines and the like, including a first and a second tubular element (2, 3) positioned coaxially to each other to respectively define an upstream (4) and a downstream passageway (5) and between which a diaphragm (7) of elastically deformable material is transversely positioned, said diaphragm (7) sealingly cooperating with an annular valve seat (14) of the said first tubular element (2) to form a fluid seal that maintains said check valve (6) in a normally closed position, and in which a predetermined fluid pressure in the said upstream passageway (4) causes a deflection of said diaphragm (7) and consequent opening of said check valve (6), wherein:

   - said annular valve seat is defined by a front surface (14) of said first tubular element (2),
   - said diaphragm consists of the bottom wall (9) of a cup-shaped element (7) positioned coaxially with said upstream and downstream passageways (4, 5) and having a lateral wall (10),
   - deflexion of said bottom wall (9) of said cup-shaped element (7) produced in use by said predetermined fluid pressure causing axial separation thereof relative to said annular valve seat (14),

   characterised in that said cup-shaped element (7) is subjected to a predetermined axial preloading so as to urge, in said normally closed condition, said bottom wall (9) into seal contact against said annular valve seat (14) under an axial thrust provided by the lateral wall (10) of said cup-shaped element (7);

2. A valve according to Claim 1, **characterized in that** the said side wall (10) of said cup-shaped element (7) has a free edge (11) resting upon a channelled surface (17) of the said second tubular element (3), said channelled surface (17) communicating with said downstream passageway (5).

3. A valve according to Claim 2, **characterized in that** the said side wall (10) of the cup-shaped element (7) has a cylindrical surface.

4. A valve according to Claim 2, **characterized in that** the said side wall (10) of the cup-shaped element (7) has a conical surface diverging towards said channelled surface (17).

5. A valve according to Claim 2, **characterized in that** the said channelled surface (17) has a halo of radial channels (15), each merging into a respective axial channel (16) formed in said second tubular element (3) and facing said side wall (10) of the cup-shaped element (7).

6. A valve according to Claim 1, **characterized in that** said front surface defining said annular valve seat (14) is oriented perpendicularly to the axis of said first tubular element (2).

7. A valve according to Claim 1, **characterized in that** said front surface defining said annular valve seat (14) is oriented with an angle different than 90° relative to the axis of said first tubular element (2).

8. A valve according to Claim 1, **characterized in that** said bottom wall (9) of said cup-shaped element (7) is formed with an annular rib defining a sealing lip facing (12) towards said valve seat (14)..

9. A valve according to Claim 1, **characterized in that** said bottom wall (9) of said cup-shaped element (7) has a variable thickness.

10. A valve according to Claim 9, **characterized in that** said bottom wall (9) of said cup-shaped element (7) has a central portion having a reduced thickness.

11. A valve according to Claim 10, **characterized in that** said central portion of the bottom wall (9) of said cup-shaped element (7) is formed with a recess (18).

12. A valve according to Claim 11, **characterized in that** said recess (18) is diametrally oriented.

13. A valve according to Claim 1, **characterized in that** said bottom wall (9) of said cup-shaped element (7) is slightly convex towards said valve seat (14).

14. A valve according to Claim 3 or 4, **characterized in that** said lateral wall (10) of said cup-shaped element (7) has an increasing thickness from said bottom wall (9) towards said free edge (11).

15. A valve according to any of the preceding Claims, **characterized in that** said bottom wall (9) of said cup-shaped element (7) has an axially projecting dome portion (8) defining said diaphragm.

16. A valve according to any of the preceding Claims, **characterized in that** the said cup-shaped element (17) is formed from a single piece of soft elastomeric material, namely liquid silicone or thermoplastic rubber, that is injection moulded using a central injection point.

17. A valve according to any of the preceding Claims, **characterized in that** the said first and second tubular elements (2, 3) are set up for tube-tube, Luer-tube, tube-Luer or Luer-Luer connections on the said medical line.

Patentansprüche

1. Steuerventil (6) für medizinische Infusionsleitungen und dergleichen, umfassend, ein erstes und zweites Rohrelement (2, 3), die koaxial zueinander angeordnet sind, um jeweils ein Zulaufseiten- (4) und eine Ablaufseiten-Durchlauf (5) zu definieren, wobei zwischen diesen ein Diaphragma (7) aus elastisch verformbarem Material quer angeordnet ist, worin das Diaphragma (7) mit einem ringförmigen Ventilsitz (14) des ersten Rohrelements (2) dichtend zusammenwirkt, um eine Fluid-Dichtung zu bilden, die das Steuerventil (6) normalerweise in einer geschlossenen Position hält, und worin ein bestimmter Flüssigkeitsdruck in dem Zulaufseitendurchlauf (4) eine Verformung des Diaphragmas (7) und eine darauffolgende Öffnung des Steuerventils (6) bewirkt, worin:

   - der ringförmige Ventilsitz durch eine vordere Oberfläche (14) des ersten Rohrelements (2) definiert ist,
   - das Diaphragma aus der Bodenwandung (9) eines Becher-förmigen Elements (7) besteht, das koaxial zu den Zulaufseiten- und Ablaufseiten-Durchläufen (4, 5) positioniert ist, und eine Seitenwandung (10) aufweist, worin die während des Gebrauchs durch den bestimmten Flüssigkeitsdruck erzeugte Verformung der Bodenwandung (9) des Becher-formigen Elements (7) eine axiale Trennung davon relativ zu dem ringförmigen Ventilsitz (14) bewirkt,

   dadurch gekennzeichnet, dass das Becher-förmige Element (7) einer bestimmten axialen Vorbelastung ausgesetzt ist, um die Bodenwandung (9) in der normal geschlossenen Position unter einer axialen Schubkraft, die durch die Seitenwandung (10) des Becher-förmigen Elements (7) bereitgestellt wird, in dichtenden Kontakt gegen den ringförmigen Ventilsitz (14) zu drängen.

2. Ventil nach Anspruch 1, **dadurch gekennzeichnet, dass** die Seitenwandung (10) des Becher-förmigen Elements (7) einen freie Kante (11) aufweist, die an einer geriffelten Oberfläche (17) des zweiten Rohrelements (3) ruht, worin die geriffelte Oberfläche (17) mit dem Ablaufseiten-Durchlauf (5) in Verbindung steht.

3. Ventil nach Anspruch 2, **dadurch gekennzeichnet, dass** die Seitenwandung (10) des Becher-förmigen Elements (7) eine zylindrische Oberfläche aufweist.

4. Ventil nach Anspruch 2, **dadurch gekennzeichnet, dass** die Seitenwandung (10) des Becher-förmigen Elements (7) eine konische Oberfläche aufweist, die gegen die geriffelte Oberfläche (17) auseinanderläuft.

5. Ventil nach Anspruch 2, **dadurch gekennzeichnet, dass** die geriffelte Oberfläche (17) einen Hof an radial verlaufenden Kanälen (15) aufweist, worin jeder in einen entsprechenden axialen Kanal (16) verschmilzt, der in dem zweiten Rohrelement (3) ausgebildet ist, und der Seitenwandung (10) des Becher-förmigen Elements (7) gegenübersteht.

6. Ventil nach Anspruch 1, **dadurch gekennzeichnet, dass** die vordere Oberfläche, die den ringförmigen Ventilsitz (14) definiert, senkrecht zur Achse des ersten Rohrelements (2) ausgerichtet ist.

7. Ventil nach Anspruch 1, **dadurch gekennzeichnet, dass** die vordere Oberfläche, die den ringförmigen Ventilsitz (14) definiert, mit einem um 90° unterschiedlichen Winkel relativ zur Achse des ersten Rohrelements (2) ausgerichtet ist.

8. Ventil nach Anspruch 1, **dadurch gekennzeichnet, dass** die Bodenwandung (9) des Becher-förmigen Elements (7) mit einer ringförmigen Rippe ausgebildet ist, die eine Dichtungslippe (12) bestimmt, die dem Ventilsitz (14) gegenüberliegt.

9. Ventil nach Anspruch 1, **dadurch gekennzeichnet, dass** die Bodenwandung (9) des Becher-förmigen Elements (7) eine variable Dicke aufweist.

10. Ventil nach Anspruch 9, **dadurch gekennzeichnet, dass** die Bodenwandung (9) des Becher-förmigen Elements (7) einen zentralen Bereich mit einer verringerten Dicke aufweist.

11. Ventil nach Anspruch 10, **dadurch gekennzeichnet, dass** der zentrale Bereich der Bodenwandung (9) des ringförmigen Elements (7) mit einer Vertiefung (18) ausgebildet ist.

12. Ventil nach Anspruch 11, **dadurch gekennzeichnet, dass** die Vertiefung (18) diametrisch ausgerichtet ist.

13. Ventil nach Anspruch 1, **dadurch gekennzeichnet, dass** die Bodenwandung (9) des Becher-förmigen Elements (7) leicht gegen den Ventilsitz (14) gewölbt ist.

14. Ventil nach Anspruch 3 oder 4, **dadurch gekennzeichnet, dass** die Seitenwandung (10) des Becher-förmigen Elements (7) von der Bodenwandung (9) gegen die freie Kante (11) hin eine ansteigende Dicke aufweist.

15. Ventil nach einem der vorangegangenen Ansprüche, **dadurch gekennzeichnet, dass** die Bodenwandung (9) des Becher-förmigen Elements (7) einen axialen nach vorne ragenden Kuppelbereich (8) aufweist, der das Diaphragma definiert.

16. Ventil nach einem der vorangegangenen Ansprüche, **dadurch gekennzeichnet, dass** das Becherförmige Element (17) aus einem einzelnen Stück von weichem elastomerem Material, nämlich flüssigem Silikon oder thermoplastischem Gummi gebildet ist, das unter Verwendung eines zentralen Injektionspunktes spritzgegossen wird.

17. Ventil nach einem der vorangegangenen Ansprüche, **dadurch gekennzeichnet, dass** das erste und zweite Rohrelement (2, 3) an der medizinischen Leitung für eine Rohr-Rohr-, Luer-Rohr-, Rohr-Luer- oder Luer-Luer-Verbindung angeordnet ist.

Revendications

1. Soupape anti-retour (6) pour lignes de perfusion médicale et analogues, comprenant un premier et un second élément tubulaire (2, 3) positionnés coaxialement l'un par rapport à l'autre pour définir respectivement une voie de passage en amont (4) et en aval (5) et entre lesquels un diaphragme (7) en matériau élastiquement déformable est positionné transversalement, ledit diaphragme (7) coopérant hermétiquement avec un siège de soupape annulaire (14) dudit premier élément tubulaire (2) pour former un dispositif d'étanchéité pour fluide qui maintient ladite soupape (6) dans une position normalement fermée, et dans laquelle une pression de fluide prédéterminée dans ladite voie de passage en aval (4) provoque une déflection dudit diaphragme (7) et une ouverture consécutive de ladite soupape anti-retour (6), dans laquelle :

   - ledit siège de soupape annulaire est défini par une surface avant (14) dudit premier élément tubulaire (2),
   - ledit diaphragme se compose d'une paroi inférieure (9) d'un élément en forme de coupelle (7) positionné coaxialement avec lesdites voies de passage en amont et en aval (4, 5) et ayant une paroi latérale (10), la déflection de ladite paroi inférieure (10) dudit élément en forme de coupelle (7) produite, en fonctionnement, par ladite pression de fluide prédéterminée provoquant la séparation axiale de celui-ci par rapport audit siège de soupape annulaire (14),

   caractérisée en ce que ledit élément en forme de coupelle (7) est soumis à une précontrainte axiale prédéterminée de manière à pousser, dans ladite position normalement fermée, ladite paroi inférieure (9) en contact de scellement contre ledit siège de soupape annulaire (14) sous une poussée axiale fournie par la paroi latérale (10) dudit élément en forme de coupelle (7).

2. Soupape anti-retour selon la revendication 1, **caractérisée en ce que** ladite paroi latérale (10) dudit élément en forme de coupelle (7) présente un bord libre (11) reposant sur une surface tunnélisée (17) dudit second élément tubulaire (3), ladite surface tunnélisée (17) communicant avec ladite voie de passage en aval (5).

3. Soupape anti-retour selon la revendication 2, **caractérisée en ce que** ladite paroi latérale (10) de l'élément en forme de coupelle (7) présente une surface cylindrique.

4. Soupape anti-retour selon la revendication 2, **caractérisée en ce que** ladite paroi latérale (10) de l'élément en forme de coupelle (7) présente une surface conique divergeant vers la surface tunnélisée (17).

5. Soupape anti-retour selon la revendication 2, **caractérisée en ce que** ladite surface tunnélisée (17) présente un halo de canaux radiaux (15), chacun

fusionnant avec un canal axial respectif (16) formé dans ledit second élément tubulaire (3) et faisant face à ladite paroi latérale (10) dudit élément en forme de coupelle (7).

6. Soupape anti-retour selon la revendication 1, **caractérisée en ce que** ladite surface avant définissant ledit siège de soupape annulaire (14) est orienté perpendiculairement à l'axe dudit premier élément tubulaire (2).

7. Soupape anti-retour selon la revendication 1, **caractérisée en ce que** ladite surface avant définissant ledit siège de soupape annulaire (14) est orienté avec un angle différent de 90° par rapport à l'axe dudit premier élément tubulaire (2).

8. Soupape anti-retour selon la revendication 1, **caractérisée en ce que** ladite paroi inférieure (9) dudit élément en forme de coupelle (7) est formée avec une nervure annulaire définissant une lèvre d'étanchéité (12) faisant face en direction dudit siège de soupape (14).

9. Soupape anti-retour selon la revendication 1, **caractérisée en ce que** ladite paroi inférieure (9) dudit élément en forme de coupelle (7) présente une épaisseur variable.

10. Soupape anti-retour selon la revendication 9, **caractérisée en ce que** la paroi inférieure (9) dudit élément en forme de coupelle (7) présente une partie centrale présentant une épaisseur réduite.

11. Soupape anti-retour selon la revendication 10, **caractérisée en ce que** ladite partie centrale de la paroi inférieure (9) dudit élément en forme de coupelle (7) est formée avec un évidement (18).

12. Soupape anti-retour selon la revendication 11, **caractérisée en ce que** ledit évidement (18) est diamétralement orienté.

13. Soupape anti-retour selon la revendication 1, **caractérisée en ce que** ladite paroi inférieure (9) dudit élément en forme de coupelle (7) est légèrement convexe en direction dudit siège de soupape (14).

14. Soupape anti-retour selon la revendication 3 ou 4, **caractérisée en ce que** ladite paroi latérale (10) dudit élément en forme de coupelle (7) présente une épaisseur croissante depuis ladite paroi inférieure (9) en direction dudit bord libre (11).

15. Soupape anti-retour selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ladite paroi latérale (9) dudit élément en forme de coupelle (7) présente une partie de dôme (8) se projetant axialement définissant ledit diaphragme.

16. Soupape anti-retour selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ledit élément en forme de coupelle (17) est formé d'un seul morceau d'élastomère, à savoir, de silicone liquide ou de caoutchouc thermoplastique, c'est-à-dire, de la fabrication injectée à l'aide d'un point d'injection central.

17. Soupape anti-retour selon l'une quelconque des revendications précédentes, **caractérisée en ce que** lesdits premier et second éléments tubulaires (2, 3) sont créés pour des connexions de type tube-tube, Luer-tube, tube-Luer ou Luer-Luer sur ladite ligne médicale.

Fig_1

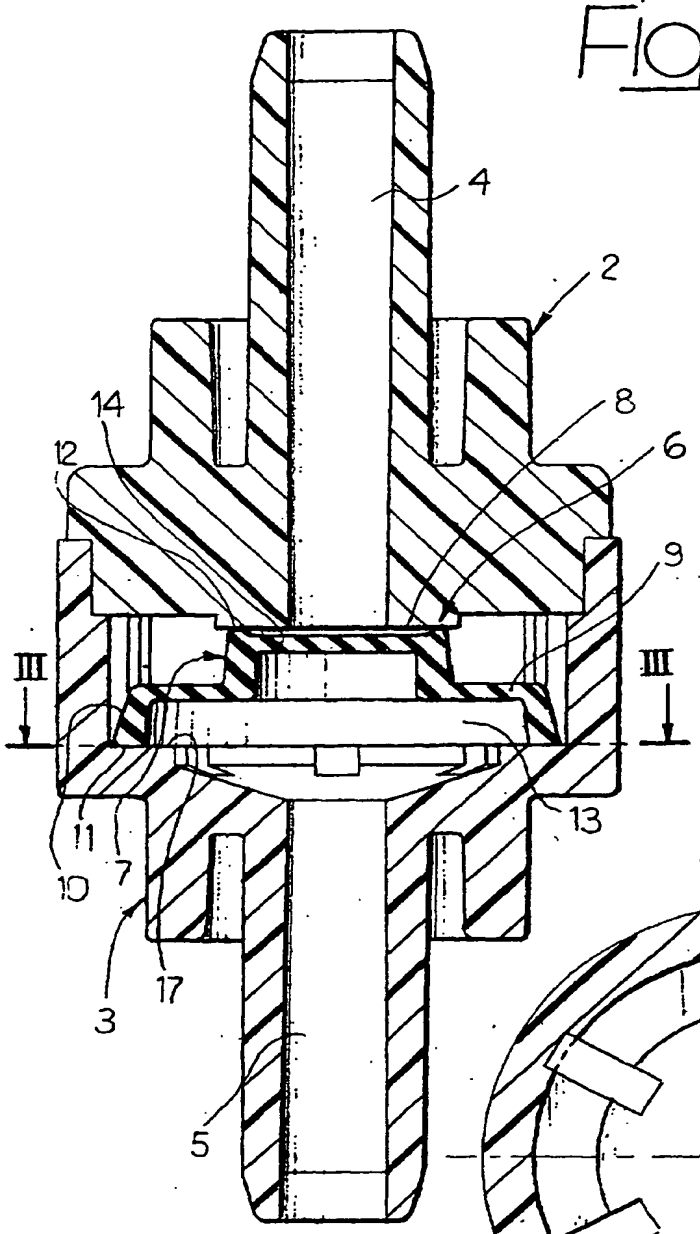

Fig_3

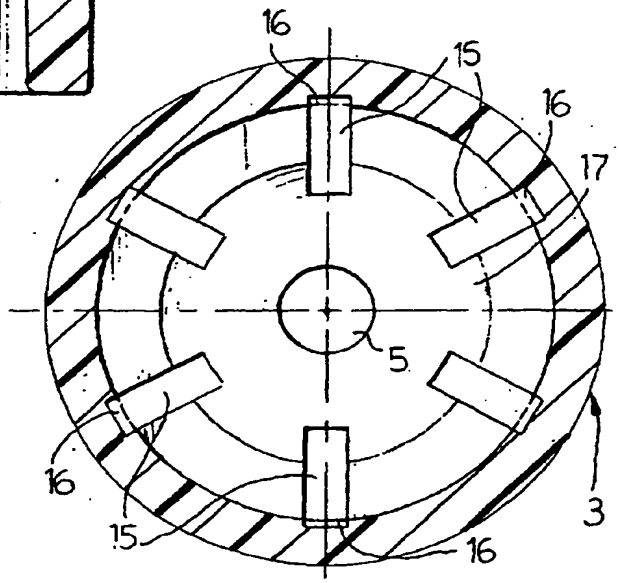

Fig_2

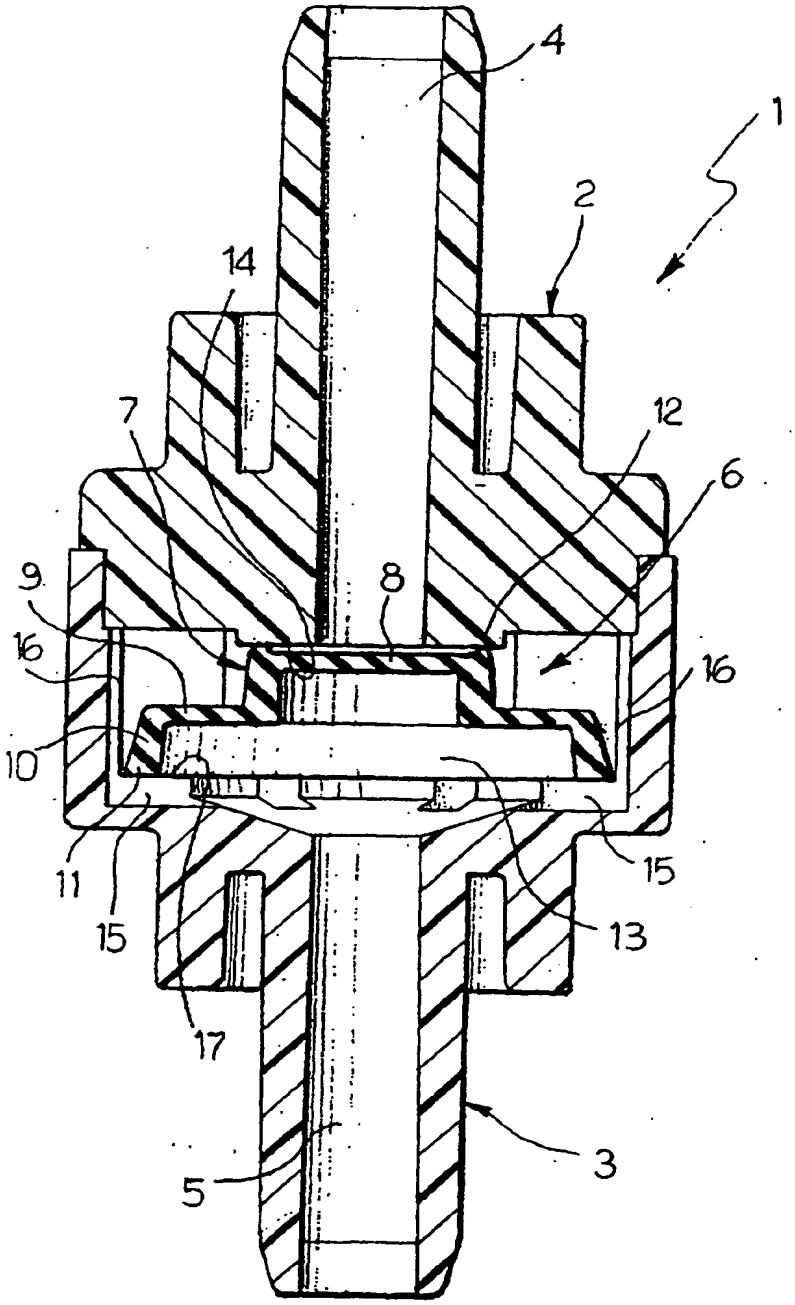

Fig.4

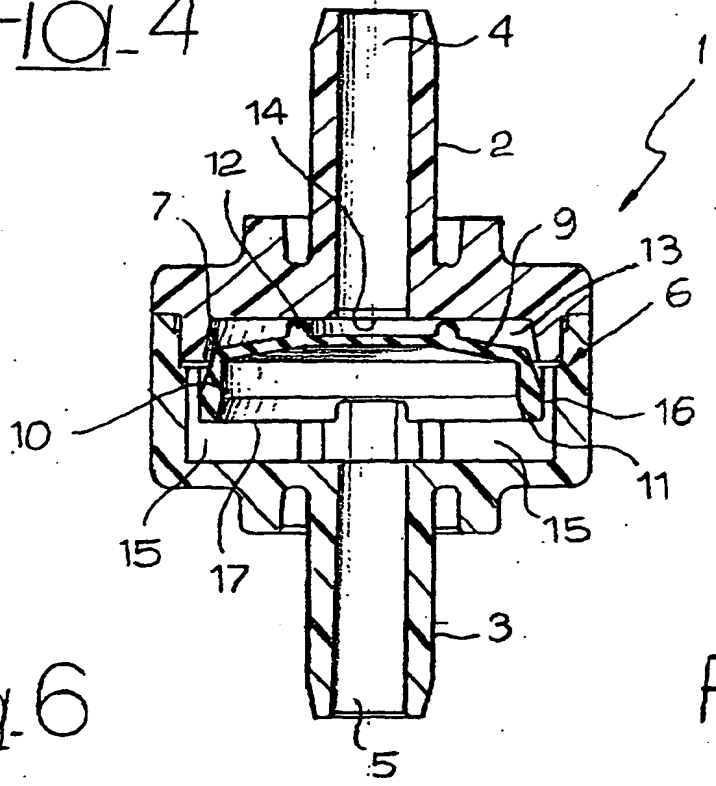

Fig.6

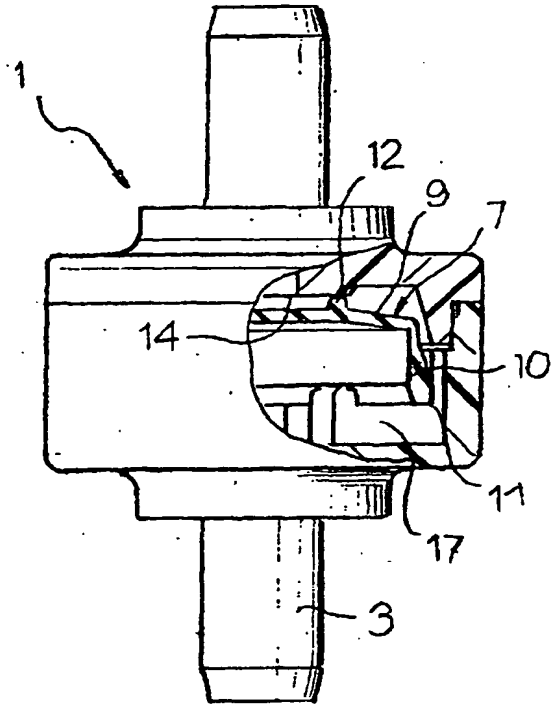

Fig.5

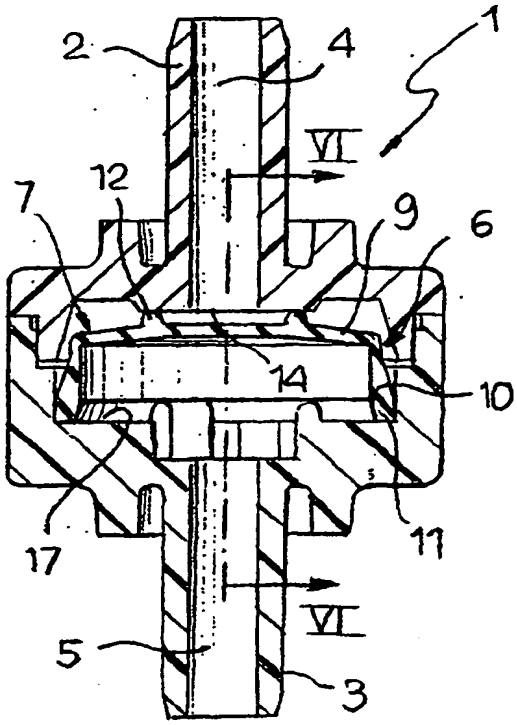

Fig. 7

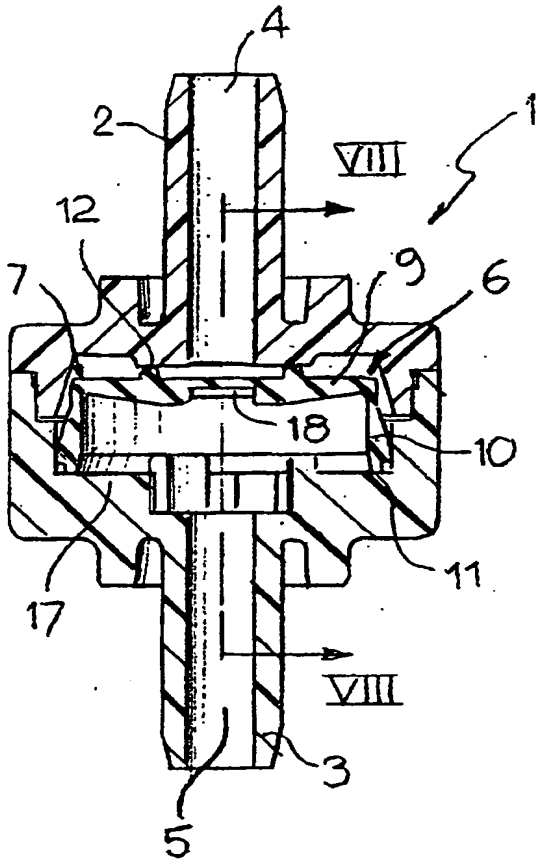

Fig. 8